USDA Biobased Products Sourcebook Outreach:

An Evaluation of Industry Perspectives on Proposed Biobased Product Content Guidelines

FINAL REPORT

Submitted by:
Concurrent Technologies Corporation
100 *CTC* Drive
Johnstown, PA

April 2002

TABLE OF CONTENTS

LIST OF ATTACHMENTS

1.0 INTRODUCTION

The activities associated with this report were detailed in the project's Statement of Work, developed by USDA:

> *Concurrent Technologies Corporation (CTC) will manage outreach efforts to relevant industry and government representatives to secure government and private sector input that will define the descriptions and content for each of the 11 identified biobased product categories. These definitions and descriptions will include a specific minimum biobased percentage for each category. This input will be provided to the USDA for review, approval, and publication in the Federal Register, alerting both industry and government agencies to these adopted standards and seeking their participation and product submissions for the USDA biobased product listing website.*

2.0 WORKED PERFORMED

2.1 DRAFT DOCUMENTS

A meeting was held on February 13, 2002 at USDA offices in Washington, DC to discuss project status and direction. Representatives of USDA and *CTC* attended the meeting. At that meeting, the number and grouping of each of the eleven proposed biobased product categories were finalized. The final adopted list included the following:

- *Adhesives*
- *Alternative Fuels and Additives*
- *Bioplastics / Polymers / Films*
- *Construction Materials / Composites / Plastic Lumber*
- *Inks*
- *Landscaping Materials / Composted Animal & Agriculture Wastes*
- *Lubricants and Functional Fluids*
- *Paints / Coatings*
- *Solvents / Cleaners*
- *Sorbents*
- *Tree Free Paper / Packaging / Fibers*

Draft documents were prepared for each of the 11 biobased product categories identified by USDA. Information used to prepare each of these documents was gathered from literature sources, Internet sites, company literature, and interviews with industry and government representatives. Gathered information was integrated into a standard format document. The standard format was discussed and accepted by USDA project leaders.

2.2 DOCUMENT REVIEWERS

Review panels for each of the 11 biobased product categories identified by USDA were recruited based on recommendations from USDA and industry points of contact. Reviewers were drawn from government, industry and trade/professional organizations.

A total of 133 draft documents were distributed to reviewers in the 11 biobased product categories – an average of more than 12 reviewers for each category. The reviewing agencies /

organizations for each of the 11 biobased product categories are provided as Attachment 1.

Reviewer comments were received by email and direct communication. Comments on the draft documents were integrated for the preparation of "Final" Draft Documents.

2.3 "FINAL" DRAFT DOCUMENTS

The deliverables for this project – "Final" Draft Documents – were prepared based on reviewer comments to the provided Draft Documents. The "Final" Draft Documents provide a definition, description and recommended minimum biobased content for each of the 11 biobased product categories identified by USDA.

Each of the 11 "Final" Draft Documents are provided in Attachment 2.0. These documents can be used by USDA to provide an industry perspective on the proposed minimum biobased content guidelines.

Attachment A:

"Final" Draft Documents:
Summary of Input on Biobased Content Guidelines

Biobased Product Category – Definitions and Descriptions

1.0 Biobased Adhesives

Biobased adhesives are chemical products used to join or bond two or more other materials together. Their use is broad and includes book bindings, envelopes, stamps, medical application such as tapes and alternatives to sutures, doors, windows, paper bonds, corrugated paper boxes, lumber, furniture and more.

A wide range of agricultural materials can be used to make *biobased adhesives*, including but not limited to, starch from corn, potatoes, wheat, tapioca, and other plants; casein from skimmed milk; soy protein; vegetable gums; gelatin; livestock derivatives; and marine animal derivatives.

Vendors should provide data for their *biobased adhesives* to document biobased content, source of biobased material (i.e. particular crop or livestock), commercial production capacity, total sales of product in 2000 and 2001 with projections for sales in 2002 and 2003 (sales presented at total weight of product sold so that the total amount of biobased materials used can be determined), that the product has low or no toxicity to human, animal, aquatic or plant, and that the product or processing of the product reduces regulated air and water emissions and solid waste disposal.

To be included in this *biobased adhesives* category, adhesive products must have a minimum biobased content of 80 % by weight. In addition, vendors of other products who certify that at least 90 % of the adhesives used in those products, e.g. furniture, are *biobased adhesives* can designate those products as biobased products. [*Biobased Content is the weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight. Vendors must provide evidence of the biobased material content in the product or system.*]

An example of a biobased adhesive is a soy-based product used to glue two pieces of wet wood. These products are environmentally friendly and create a dependable glued joint.

2.0 Biobased Construction Materials and Composites

C*onstruction materials and composites* can be made from agricultural and woody materials and residues, as well as livestock derivatives. Woody materials are those obtained from activities such as thinning, fuel reduction in plantation stands, regenerated forest stands, intensively cultivated short rotation woody stands – i.e. less than 10 years, or from wood residue or recovered wood products.

The applications in the *biobased construction materials and composites* category are broad and include wall and roof systems made from compressed wheat straw or other plant fibers; fiber board made from wheat or other cereal straw, sugarcane bagasse, or other plant fiber and chicken feather fiber; composites made from corn oil, cotton oil, linseed oil, soy oil, soybean meal or other plant proteins; molded parts from vegetable fibers; and building or office furnishings – desks, tables, cabinets – made from biobased composites. Also included are products and parts made from biobased plastics and/or reinforced with biobased fibers.

The *biobased construction materials and composites* category also includes those products containing biobased adhesives, such as plywood, finger joint lumber, engineered wood building components – laminated beams, trusses, and decorative composites. Plastic lumber, or wood substitute, can now be made with soy, wheat, and other resins blended with natural fibers resulting in a very high biobased content product.

Also included in this category are bioplastic rigid and soft foam, fiber insulation, starch admixtures, such as aqua gels, that are added to concrete mixture during setting to reduce the density of concrete, and concrete mold release agents.

Vendors should provide data for their *biobased construction materials and composites* to document biobased content, source of biobased material (i.e. particular crop or livestock), commercial production capacity, total sales of product in 2000 and 2001 with projections for sales in 2002 and 2003 (sales presented at total weight of product sold so that the total amount of biobased materials used can be determined), that the product has low or no toxicity to human, animal, aquatic or plant, and that the product or processing of the product reduces regulated air and water emissions and solid waste disposal.

To be included in the *biobased construction materials and composites* category the following minimum biobased content of each subcategory must be:

Table 1. Biobased Construction Materials and Composites – Minimum Content Guideline

Sub-category	Minimum Biobased Content (%)
Construction material	90%
Composite	70%

[*Biobased Content is the weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight*. *Vendors must provide evidence of the biobased material content in the product or system.*]

Construction Materials

This product category for biobased construction materials and composites includes biobased polyurethane made from a soybean oil polyol. Hundreds of applications can employ these materials ranging from carpet backing to foam cushions, pads for furniture, automotive seats, and dashboards; molded cases and covers for appliances, telephones, computers, rigid insulating foams used to insulate refrigerators, freezers, coolers, and appliances.

Another *biobased construction material* example is strawboard is made from wheat straw or other agricultural residues. These materials function much like the wood-based particleboard that it replaces for nonstructural applications like furniture, cabinets, and store displays. Hurricane resistant and other housing structural materials can be made with soy oil, foam and natural fibers.

Composite Materials

Highly engineered blends of recycled paper products, biobased resins and color additives can combine to provide a strong, durable composite that functions similar to wood. It can be used where the appearance of stone and the workability of wood are desired. The grain pattern is present throughout the material, which allows for three-dimensional shaping. These biobased products can be fabricated, sawed, sanded, fastened, milled, drilled, routed, inlaid, engraved, glued and jointed with similar tools and techniques used in working with traditional hardwoods. Applications include furniture, tabletops, trim, store fixtures, awards, plaques, trophies, indoor signage and other interior, non-structural uses.

Biobased composites can be used to make hay baler panels, harvester walls and tractor parts. Soy-based resins are being used with natural fiber, chicken feather, flax, and glass reinforcements for automobile body panels and truck parts.

3.0 Biobased Fibers, Paper and Packaging

Agricultural materials represent an extraordinary source of *biobased fibers.* There is a broad range of agricultural crops and livestock that contribute materials to this category including bamboo, corn stover, low grade cotton, flax, kenaf, rice straw, saw dust, sugar cane bagasse, switch grass, wheat and other straws, wood, feathers and wool.

Natural, *biobased fibers* are very ductile and typically do not splinter. Their properties have been compared to carbon and glass fibers for use in fiberglass composites. Products made from natural fiber-based composites weigh about 30 percent less than comparable wood-based products.

A variety of *biobased fibers* can be spun into ropes, textiles and yarns. For example, flax is a traditional textile fiber, used to make linen while other fibers, such as jute, are woven to make burlap for bags and coverings, while other fibers can be woven into baskets.

Biobased paper and packaging represent opportunities to use biobased materials as alternative fibers. A wide variety of *biobased fibers* can be used to produce tree-free paper, including corn stover, North America's largest source of agricultural residue. Flax fibers and wool can be used in high end paper products, kenaf is being used to make newsprint paper, bagasse, and rice straw and wood chips are also good *biobased fibers* for the production of tree free paper.

Biobased fibers can be used for *packaging* in several ways such as those used in the manufacture of containers such as boxes, drums and pails for the storage or shipment of food or manufactured products. Packages and packaging materials help protect and sustain the quality of goods during transportation and storage. The inter-actions between those goods and the package and packaging materials is important since the package provides a barrier to gases, humidity, and light which can be vital for the quality and shelf life of many retail products including foods.

Biobased fibers can also be used as bulk packaging materials such as filler and protection of stored or transported goods. Renewable alternative fibers for these purposes can be derived from a variety of agricultural materials including, but not limited to, corn stover, cotton, kenaf, wheat and other straws, chicken feathers and wool. Bulk packaging materials can even include popped corn as a direct replacement of styrene 'peanuts'.

Vendors should provide data for their biobased *fibers, paper and packaging* to document biobased content, source of biobased material (i.e. crop), commercial production capacity, total sales of product in 2000 and 2001 with projections for sales in 2002 and 2003 (sales presented at total weight of product sold so that the total amount of biobased materials used can be determined), that the product or processing of the product does not reduce the ability of the product to be recycled, that less chlorine and chlorine chemicals

were used in the processing of the product, and that the product or processing of the product reduces regulated air and water emissions and solid waste disposal.

To be included in the *biobased fiber, paper and packaging* category, the minimum biobased content must be:

Table 2. Biobased Fibers, Paper and Packaging - Minimum Content Guideline

Application	**Minimum Biobased Content (%)**
Fibers	90%
Fiber composites	30%
Woven fiber products	75%
Packaging materials	80%
Tree free uncoated printing and writing papers	20%
Tree free coated printing and writing papers	20%
Bristols	50%
Newsprint	20%
Sanitary tissues	30%
Paperboard and packaging products	30%
Other paper products	50%

[*Biobased Content is the weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight. Vendors must provide evidence of the biobased material content in the product or system.*]
[The fiber content in the above categories follow the guidance provided by U.S. EPA in the Paper Products Recovered Materials Advisory Notice, May 29, 1996.]

Strong, lightweight honeycomb panel made from recycled and agricultural fibers illustrates the use of biobased fibers. These panels can have the equivalent bending strength of particleboard at one-third the weight. The honeycomb panel can be painted, laminated and machined. The materials for the panels serve as an alternative to virgin forest products. Particleboard can be made almost entirely from straw residue. It is a direct replacement for wood particleboard or medium-density fiberboard in non-structural applications such as furniture, cabinets, store displays, door panels, moldings, and other fixtures. Biobased fibers can be blended with molten plastic in ratios of up to 70% fiber by weight to make furniture, toys and other molded products.

Pillows and comforters are made from milkweed fibers mixed with goose down to create light and fluffy, hypoallergenic bedding materials.

4.0 Biobased Fuels and Fuel Additives

A variety of *biobased fuels and fuel additives* can be made from agricultural materials, including liquid, gaseous and solid fuel products. These products can be used to power vehicles, heat buildings, provide heat for steam for industrial process, generate electricity from diesel generators, micro-turbines or fuel cells, and other applications.

Raw material sources for these biobased fuels include processed products from agricultural crops such as corn, soy bean, rapeseed, animal fat, wood, and crop and processing residues such as stalks, manure, used cooking oils, used wood, paper and paper sludge, and hulls.

Vendors should provide data for their *biobased fuels and fuel additives* to document percent biobased content, source of the biobased material (i.e. particular crop or livestock), commercial production capacity of the biobased product, total sales of product in 2000 and 2001 with projections for sales in 2002 and 2003 (sales presented at total weight of biobased product sold so that the total amount of biobased materials used can be determined), that the product has low or no toxicity to human, animal, aquatic or plant, and that the product or processing of the product reduces regulated air and water emissions and solid waste disposal.

Fuel products can be either undiluted (or 'neat') fuels, mixed or diluted with other materials as a formulated fuel, or used as an additive to enhance certain properties of a fuel. For example, ethanol can be burned directly or blended with gasoline and paper sludge can be burned directly or blended with coal or wood.

To be included in this *biobased fuels and fuel additives* category the following minimum biobased content of each subcategory must be:

Table 3. Biobased Fuels and Fuel Additives - Minimum Content Guideline

Sub-category	**Minimum Biobased Content (%)**
'Neat' products	90%
Formulated products	15%
Fuel additives	80%

[*Biobased Content is the weight of the biobased material divided by the total weight of the product and expressed as a percentage. Vendors must provide evidence of the biobased material content in the product or system.*]

Liquid Fuels

The product category of *biobased fuels and fuel additives* includes liquid fuels such as ethanol, methanol, biodiesel, and Fisher-Tropsch diesel. These biobased products can be used as vehicle fuel, heating and lighting products, or fuels to generate steam or electricity. The liquid fuels can be used as a 'neat' product or a formulated product. For example, ethanol is the most widely used *biobased fuel and fuel additive*. It is typically made by fermentation of an agricultural product or residue. Ethanol can be used directly as a fuel or can be used as an oxygenated additive and a source of octane in a formulation with other fuels. Another liquid biobased fuel is biodiesel. Biodiesel is defined as a mono-alkyl ester of vegetable oils or animal fats and has been accepted under EPACT as an alternative fuel for regulated fleets at levels as low as 20% blends with petroleum diesel. Biodiesel can be used as a 'neat' fuel, i.e. 100% biodiesel, or blended, for example 20% biodiesel, as a formulation with conventional diesel fuel.

Gaseous Fuels

The product category of *biobased fuels and fuel additives* includes gaseous fuels derived from biological sources such as hydrogen and methane. These biobased products can be burned as fuels or used for chemical conversion to generate electricity. Gaseous fuels can be used as a 'neat' product or a formulated product. For example, synthesis gas can be made from biomass. Synthesis gas is composed primarily of hydrogen and carbon monoxide. Hydrogen can be recovered from the synthesis gas or it can be converted to methanol. Synthesis gas can also be pressurized into a liquid fuel for use as a motor fuel. Another example of a gaseous fuel is methane. Methane can be produced from agricultural products or residues using anaerobic digestion or pyrollysis. These fuels can be blended with natural gas or used directly.

Solid Fuels

The product category of *biobased fuels and fuel additives* includes solid fuels containing agricultural residues or products. These biobased products can be used as fuels for stoves, furnaces, and boilers to produce direct light, heat, steam and electricity. The solid fuels can be used as a 'neat' product or a formulated product where the biobased component can be either the binder or the main fuel source.

Solid fuels in this category can contain agricultural materials such as wood and wood processing residues, formed wood residue; papers, paper sludge and other paper processing residues; grains and grain processing by-products and residues; by-products or residues from soy, cotton and sugar processing; pelletized residues from livestock production and processing, including manures.

Biobased products that are solid fuels are typically 'formed' for ease of handling into a wide variety of shapes and sizes including pellets, rolls, briquettes, and other forms. Combustible binders, which may both act as fuels and/or be blended with other primary fuels, allow the fuel to be formed into various shapes and sizes. Biobased and other binders, such as resins and propellants, are also used to facilitate ignition and combustion. Formed coal fines are one example of a solid fuel. Recovered coal fines can be formed into a variety of shapes and sizes, e.g. pellets and briquettes, by using a biobased binder

or a combination binder composed of biobased materials and other chemicals. The total biobased content is not less than 5% by weight of the final product. Biobased binders typically comprise only a small part of the total solid fuel and can be derived from dairy by-products and other agricultural sources. The binder would be considered a *biobased fuel additive.*

5.0 Inks

Inks, derived from biobased materials, have been successfully demonstrated and are increasingly accepted as viable alternatives to traditional formulations. Plant and vegetable oils can be used to make a wide variety of biobased *inks*.

Biobased *inks* can be provided in black and a variety of colors. These inks can be used to print a broad range of documents including newspapers, magazines, brochures, business cards, and reports. The inks can also be used with a variety of specialty applications including stencils, textiles, labeling as well as pens and other writing instruments.

In 1994, the U.S. Congress enacted the "Vegetable Ink Printing Act" mandating that all Federal lithographic printing be performed using ink made from vegetable oil and materials derived from other renewable resources.

Vendors should provide data for their biobased *inks* to document biobased content, source of biobased material (i.e. particular crop or livestock), commercial production capacity, total sales of product in 2000 and 2001 with projections for sales in 2002 and 2003 (sales presented at total weight of product sold so that the total amount of biobased materials used can be determined), that the product has low or no toxicity to human, animal, aquatic or plant, and that the product or processing of the product reduces regulated air and water emissions and solid waste disposal.

To be included in the *Inks* category, the minimum biobased content must be:

Table 4. Inks -
Minimum Content Guideline

Application	Minimum Biobased Content (%)
News inks – black	40%
News inks - color	30%
Sheet-fed inks	20%
Forms inks	20%
Heat-set inks	10%
Specialty inks	20%

[*Biobased Content is the weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight. Vendors must provide evidence of the biobased material content in the product or system.*]

Newspaper Printing with Soy Ink is one example of the use of biobased inks. Over 90% of all U.S. daily newspapers use soy ink that is made by blending soybean oil with pigments,

resins and waxes to make either black or color ink. Unlike petroleum inks, soy ink does not release volatile organic compounds (VOCs) into the atmosphere upon drying. Newspapers printed with soy ink are easier to recycle.

Biobased Product Category – Definitions and Descriptions

6.0 Landscaping Materials and Composted Livestock and Crop Residue

This category includes materials and products associated with *landscaping materials and composted livestock and crop residues*. Many biobased products, such as construction materials, coatings, paper, fibers and sorbents are compostable and reusable as landscaping materials.

Landscaping materials include bark, chips, mulch, and pine needles that serve aesthetic and functional purposes. Various agricultural crops and residues, including straws and short rotation woody crops are the sources of these products. For the purposes of this category, woody materials are those obtained from activities such as thinning, fuel reduction in plantation stands, regenerated forest stands, intensively cultivated short rotation woody stands, i.e. less than 10 years old, or from wood residue or recovered wood products.

Compost is derived from a managed process, known as composting, that decomposes and transforms organic material into a soil-like product called humus. Food scraps, leaves, paper, wood, livestock manures, and agricultural residues are excellent organic materials that can be composted. *Composting* reduces the amount of waste that may go to a landfill and it produces a valuable soil amendment that can improve the texture and fertility of the soil. The *composting* process uses microorganisms such as bacteria and fungi to break down organic materials. For the process to work best, it is important that these microorganisms have an adequate supply of organic material, water and oxygen. Managing the temperature of the *composting* material is also important to make the process work. When the *composting* process is complete, the finished product is a valuable soil amendment that is rich in organic matter.

Mulches and composted materials can be used to control moisture and nutrients in soils and reduce the potential for erosion.

Vendors should provide data for their biobased *landscaping materials and composted livestock and crop residue* to document biobased content, source of biobased material (i.e., particular crop or livestock), commercial production capacity, total sales of product in 2000 and 2001 with projections for sales in 2002 and 2003 (sales presented at total weight of product sold so that the total amount of biobased materials used can be determined), that the product has low or no toxicity to human, animal, aquatic or plant, and that the product or processing of the product reduces regulated air and water emissions and solid waste disposal.

To be included in the *landscaping materials and composted livestock and crop residue* category the following minimum biobased content of each subcategory must be:

Table 5. - Minimum Content Guideline –
Landscaping Materials and Composted Livestock and Crop Residue

Sub-category	**Minimum Biobased Content (%)**
Landscaping materials	100%
Composted residues	100%

[*Biobased Content is the weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight. Vendors must provide evidence of the biobased material content in the product or system.*]

Compost can be blended with poor soils to enhance the characteristics of the poor soil and improve the soil quality. Compost can also be used to control soil erosion when uniformly applied at thicknesses of 2 to 4 inches on slopes of up to 2:1. Slopes with problem soils and more runoff typically require greater application rates. On highly unstable soils, compost can be used in conjunction with appropriate structural measures.

7.0 Biobased Lubricants and Functional Fluids

Biobased lubricants and functional fluids are important materials used to reduce friction between moving surfaces or between moving and stationary surfaces in engines and other machinery to reduce wear and dissipate heat on those surfaces and to provide other benefits such as corrosion protection. *Biobased functional fluids* are used to transfer heat and/or pressure to or from surfaces, reduce friction in machining operations, provide electrical insulation and for many more purposes. There is a broad range of *biobased lubricant and functional fluid* products, each carefully designed and developed to meet particular performance needs and applications. These materials often need to be replaced on a routine schedule to maintain their expected performance.

Vehicles, heavy machinery and mobile equipment use lubricants such as crankcase oils and greases, and functional fluids such as transmission fluids, coolants, power steering fluids, brake fluids and others. Industrial equipment uses for lubricants include metal working fluids (cutting and drilling oils and lubricants and stamping and forming lubricants), hydraulic fluids and process fluids (heat transfer and dielectric fluids). Total loss lubricants are released directly into the environment when applied as rail and flange, wire rope, and chain saw lubricants; concrete and asphalt form release fluids; and two-cycle engine oils.

Biobased lubricants and functional fluids are typically made from multiple components including one or more base stocks plus additives that enhance performance or extend the life of the product. A variety of agricultural-based oils can be used as *biobased lubricants and functional fluids*, including but not limited to, canola, corn, rapeseed, soybean, sunflower, other plant materials, and animal fats. The base oil used must have sufficient natural or enhanced stability to be used as base stock for biobased lubricants. Biobased products in this category can be base stock (the starting material into which additives and other materials are blended to make the final formulated product), lubricant or functional fluid additive (materials that are used for specific performance benefits such as lower pour point, increase flash point, greater extreme pressure properties, a desired viscosity or reduced foam), or formulated lubricant or functional fluid (the final product including base stock and all additives).

Vendors should provide comparative data for their biobased *lubricants and functional fluids* to document biobased content, source of biobased material (i.e. crop), commercial production capacity, total sales of product in 2000 and 2001 with projections for sales in 2002 and 2003 (sales presented at total weight of product sold so that the total amount of biobased materials used can be determined), that the product has low or no toxicity to human, animal, aquatic or plant, and that the product or processing of the product reduces regulated air and water emissions and solid waste disposal.

To be included in this *lubricants and functional fluids* category the following minimum biobased content of each subcategory must be:

Table 6. - Minimum Content Guideline –
Biobased Lubricants and Functional Fluids

Sub-category	**Minimum Biobased Content (%)**
Base stock	90%
Additive	70%
Formulated product	15%

[*Biobased Content is the weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight*. *Vendors must provide evidence of the biobased material content in the product or system.*]

Lubricants
Two-Cycle Engine Oils can be formulated from biobased products. These formulated lubricants are added to fuels used in 2-cycle engines such as those found in lawnmowers, chainsaws, string trimmers, and other small machinery. *Biobased lubricants* can include bar, chain and sprocket oils or general purpose lubricants used for general cleaning, lubrication and corrosion prevention of metal parts including wheels, bearings, gears, rollers, chains, hinges, hand tools, guns, and sporting equipment.

Hydraulic Fluids
Biobased hydraulic fluids can be used in construction equipment, industrial pumps, and other equipment as well as specialty uses where incidental food contact may occur. These specialty fluids can also be used in transmission systems of vehicles and other transportation equipment.

Metalworking Fluids
Biobased functional fluids include the fluids used to lubricate and cool metals and non-metal parts during cutting and parts fabrication as well as drilling and machining operations. These specialty fluids are also used to provide cooling of parts and equipment during manufacturing processes.

Other Fluids
Biobased functional fluids can be used for specialty purposes such as mold release agents that are applied to wood, metal or plastic forms prior to pouring concrete to facilitate the removal of forms after concrete has cured or to foundry molds prior to pouring the foundry metal to facilitate the removal of metal parts from the molds. These biobased products can also be used as dielectric fluids that are used in electric transformers to provide electric insulation and to dissipate heat generated by the transmission of electric current.

8.0 Biobased Paints and Coatings

Paints and other types of coatings such as stains, varnishes and sealants can be derived from agricultural materials. These coatings serve the critical function of enhancing the appearance and protecting the materials onto which they are applied. The protective function includes reducing corrosion, water infiltration, weathering from sun and wind exposure, and other damage. Agriculture based coatings are important alternatives to traditional paints and coatings that are derived from petroleum-based chemicals and metal pigments. *Biobased paints and coatings* have been demonstrated to be as durable, glossy and have similar flow characteristics as synthetic paints.

Biobased Paints and Coatings have a wide range of uses that include protection of seeds to enhance germination, marine coatings, concrete and wood sealers, stains, corrosion inhibitors, and polishes.

A wide variety of agricultural materials can be used in *biobased paint and coatings* applications including: xanthan gum helps thicken latex paints and coatings, and uniformly suspend zinc, copper, and other metal additives in corrosion control coatings; cellulose esters and ethers can be used to make lacquers and paints; guayule derived epoxy-amine can be used to make coatings for metal panels that help protect the metal from corrosion during exposure to fog and salt; corn, soy, wheat and other proteins are used to make coatings for paper and cardboard; epoxidized soybean oil can be used as an intermediate chemical in the manufacture of paints.

Vendors should provide data for their *biobased paints and coatings* to document biobased content, source of biobased material (i.e. particular crop or livestock), commercial production capacity, total sales of product in 2000 and 2001 with projections for sales in 2002 and 2003 (sales presented at total weight of product sold so that the total amount of biobased materials used can be determined), that the product has low or no toxicity to human, animal, aquatic or plant, and that the product or processing of the product reduces regulated air and water emissions and solid waste disposal.

To be included in this *biobased paints and coatings* category the following minimum biobased content of each subcategory must be:

Table 7. - Minimum Content Guideline –
Biobased Paints and Coatings

Sub-category	**Minimum Biobased Content (%)**
Formulated product	20%

[*Biobased Content is the weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight. Vendors must provide evidence of the biobased material content in the product or system.*]

Biobased Product Category – Definitions and Descriptions

9.0 Biobased Plastics – Monomers and Polymers

Plastics are materials typically made from oil-based monomers and polymers. Almost all plastics used are made from synthetic, e.g. oil-based, monomers and polymers. Plastics can, however, be derived from a wide variety of agricultural materials in the form of (a) starch, cellulose, and other polymers or (b) synthesized from plant oil and process by-product monomers.

These agricultural derived *bioplastics* are from renewable resources, are typically biodegradable, and are typically not toxic to produce. *Bioplastic polymers* include cellulose - the most plentiful carbohydrate since 40 percent of all organic matter in the world is cellulose; starch - found in corn, potatoes, wheat, tapioca, and other plants can be used for non-food purposes such as paper, cardboard, textile sizing, and adhesives; collagen - the most abundant protein found in mammals including gelatin is used to make sausage casings, capsules for drugs and vitamin preparations, and other miscellaneous industrial applications including photography; casein – a commercial product derived mainly from skimmed milk is used in adhesives, binders, protective coatings, and other products; corn, soy and wheat proteins are abundant and can be used to make adhesives and coatings for paper and cardboard; polyesters are produced by bacteria through fermentation processes and are used in biomedical applications.

The plastic materials made with bio-based monomers such as plant oils, propane diol and lactic acid can be made to closely resemble the molecular structures of petroleum based plastics and that will provide particular performance and application benefits, e.g. thermoplastic or thermoset characteristics, pressure sensitivity, elastomer, or other, characteristics.

Products made from *bioplastics and biopolymers* can be extruded or molded as formed products or rolled as films. Formed products include cutlery, plates, bowls and packaging ‘peanuts’ while films can include wrapping materials, shopping and trash bags, capsules, pressure sensitive adhesives, and casings. In addition, chemically modified biopolymers can be used as specialty chemicals in such uses as surfactants, plasticizers, lubricants, and in the manufacture of vinyl plastics, paints, and polyurethane for cushions and pads.

Vendors should provide data for their biobased *bioplastics and biopolymers* to document biobased content, source of biobased material (i.e. particular crop or livestock), commercial production capacity, total sales of product in 2000 and 2001 with projections for sales in 2002 and 2003 (sales presented at total weight of product sold so that the total amount of biobased materials used can be determined), that the product has low or no toxicity to human, animal, aquatic or plant, and that the product or processing of the product reduces regulated air and water emissions and solid waste disposal.

To be included in this *bioplastics and biopolymers* category the following minimum biobased content of each subcategory must be:

Table 8. - Minimum Content Guideline –
Biobased Plastics – Monomers and Polymers

Sub-category	**Minimum Biobased Content (%)**
Base stock	70%
Additive	90%

[*Biobased Content is the weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight*. *Vendors must provide evidence of the biobased material content in the product or system.*]

Examples of the application of *bioplastics* include food clamshells, trays, and hot cups, which have similar performance characteristics as petroleum-derived disposable products. Plastic films can be made with starch and other additives for use as grocery and garbage bags. Agricultural resins can be molded into various shapes including knives, forks and spoons. These utensils have comparable performance characteristics to petroleum-derived plastics but are more easily assimilated into the environment upon disposal through rapid material breakdown and composting.

Water treatment chemicals can be made from *bioplastics* such as starch xanthate. These products can help the mining and heavy industries clean heavy metals from their discharge water. When added to mercury-laden wastewater, these materials attract the heavy metal, combine with it, and settle to the bottom of retention tanks. The starch xanthate also works for other heavy metals such as, lead, silver, chromium, cadmium, copper, and nickel.

Other products from *bioplastics* include automobile, truck and farm equipment companies using molded parts derived from bioplastics in various applications for their vehicles and machinery. This includes a polypropylene plastic and kenaf-fiber composite for interior door panels, and trunk liners. Tractor panels and hay baler parts are being made from soy-based fiberglass composites. Plastic lumber can be made from soy, wheat and other resins when reinforced with natural fibers. Biobased pressure sensitive adhesives have been developed for clear tape, duct tape, masking tape, labels, and a variety of disposable items.

10.0 Biobased Solvents and Cleaners

Biobased solvents and cleaners are widely used as cleaners and degreasers in manufacturing and other processes and as product ingredients in adhesives, paints, and coatings. These materials tend to be less volatile compared to comparative petroleum-based products, are typically non-reactive with other chemicals, are non-corrosive, and are rapidly assimilated into the environment. Solvent and cleaner applications are broad and include alternatives to petroleum chemicals such as trichlorethylene, xylene, toluene, and methylene chloride, fabric and textile cleaning, fruit and vegetable cleaning, removal of grease, tar, oil, stains, paints from concrete and metal surfaces, paint stripper from metals and wood, carpet and upholstery cleaner, solvent for inks, paints and other materials, graffiti remover, and industrial parts cleaning.

Biobased solvents and cleaners are made from renewable agricultural materials, including crops, including corn and soy, and livestock.

Vendors should provide data for their biobased *solvents and cleaners* to document biobased content, source of biobased material (i.e. particular crop or livestock), commercial production capacity, total sales of product in 2000 and 2001 with projections for sales in 2002 and 2003 (sales presented at total weight of product sold so that the total amount of biobased materials used can be determined), that the product has low or no toxicity to human, animal, aquatic or plant, and that the product or processing of the product reduces regulated air and water emissions and solid waste disposal.

Biobased products in this category can be 'neat' or concentrated products that are used directly or blended with other materials prior to use, or formulated products.

To be included in this *solvents and cleaners* category the following minimum biobased content of each subcategory must be:

Table 9. - Minimum Content Guideline – Biobased Solvents and Cleaners

Sub-category	Minimum Biobased Content (%)
'Neat' or concentrate product	90%
Formulated product	50%

[*Biobased Content is the weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight. Vendors must provide evidence of the biobased material content in the product or system.*]

Product Examples

Industrial Cleaners and Degreasers

Parts Cleaning Compounds are products containing one or more *biobased solvent* that are formulated with other performance additives such as surfactants, biocides, and rheology agents. These products are used in manufacturing and fabrication operations for cleaning parts prior to assembly or in repair operations such as automotive shops. They may be combined with other technologies such as supercritical fluid cleaning, media blasting, ultra-sonic, vibratory cleaning, or vapor degreasing. Metal Cleaners can be neat or formulated products used for cleaning large metal surfaces such as the interior of storage tanks and ship holds. Printing Ink Removers are formulated products used for the removal of ink from printing presses and other printing equipment, such as press and blanket washes, and screen cleaners. Adhesive/mastic removers are generally formulated products designed to remove adhesives or mastics from machinery used in gluing applications or from surfaces where an adhesive or mastic has been applied such as with tile removal. Paint Strippers are generally formulated products designed to remove paints from wood or metal surfaces. Asphalt Removal and Release materials are formulated or neat solvent products used to remove built up asphalt from machinery or used as a pre-spray for dump trucks to prevent sticking of asphalt to truck beds.

Institutional Cleaners and Degreasers

Hard Surface Cleaners include general-purpose formulated products for the removal of greases and other dirt from metal, tile, glass, plastics and hard surfaces. Glass cleaners are generally formulated products for the removal of dirt from glass surfaces with minimal or no film residues. Food Machinery Cleaners are formulated products used to remove accumulated greases and soils from metal and non-metal parts of food machinery such as meat saws and slicers, vent fans, ovens, cooking vats, etc. These should be approved for incidental food contact or certified by the manufacturer as generally regarded as safe. Textile cleaners are formulated products for the removal of heavy stains from textiles prior to institutional cleaning (dry cleaning or laundry). Graffiti Removers are formulated products for the removal of graffiti (spray paint, markers, crayons, etc.) from metal and or wood surfaces. Concrete, Stone and Masonry Cleaners are formulated products that remove oil, grease, soot and other soils from concrete driveways/sidewalks, stone and masonry.

Household Cleaners and Other Products

Hand cleaners and Soaps are formulated products for the removal of heavy greases and dirt from skin. Laundry Aids include stain removers and pre-washes for the treatment of stains on fabrics. Wood Cleaners and Polishes are formulated products for cleaning and polishing of wood surfaces and furniture.

11.0 Biobased Sorbents

Biobased sorbents are materials that are used to take up and hold liquids. Their use is broad and includes collection of oil and other environmental spills, collection of blood and other fluids in medicinal and surgical applications, collection of urine in diapers and incontinence products, and animal bedding.

There are three mechanisms by which liquids are collected by the sorbent: *absorption, adsorption*, or both. *Absorbents* allow the liquid to penetrate into pore spaces in the sorbent material they are made of, while *adsorbents* attract the liquid to the sorbent surface but do not allow the liquid to penetrate into the sorbent.

A wide range of agricultural materials can be used as *biobased sorbents*, including but not limited to wool, cotton and cotton linters, vegetable starch, kenaf, and agricultural residues such as but not limited to corn stover and peanut hulls. Biobased Products in this category must address the function of the entire product, e.g., the sorbent itself as well as the casing or framework holding or enclosing the sorbent.

Vendors should provide data for their *biobased sorbents* to document biobased content, source of biobased material (i.e. particular crop or livestock), commercial production capacity, total sales of product in 2000 and 2001 with projections for sales in 2002 and 2003 (sales presented at total weight of product sold so that the total amount of biobased materials used can be determined), that the product has low or no toxicity to human, animal, aquatic or plant, and that the product or processing of the product reduces regulated air and water emissions and solid waste disposal.

The *biobased sorbents* product category is organized as two broad groups of products: sorbents and sorbent systems. To be included in this category, the following minimum biobased content of each subcategory must be:

Table 10. - Minimum Content Guideline – Biobased Sorbents

Sub-category	Minimum Biobased Content (%)
Sorbents	90%
Sorbent systems	75%

[*Biobased Content is the weight of the biobased material divided by the total weight of the product and expressed as a percentage. Vendors must provide evidence of the biobased material content in the product or system.*]

Sorbents

The product category of *biobased sorbents* includes those products derived from plant or animal matter. Excluded from this category are sorbents such as clay or peat that are extracted from the earth. It is USDA's intent that the active sorbent be a biobased product.

For example, cotton fibers can be used to make pads or booms and cotton lint is used as a dry absorbent that can be spread onto the liquids. Low value wool can also be used to make absorbent pads.

Kenaf, a fast-growing, drought-resistant, non-wood fiber plant, is related to okra and cotton. The dried stalks of the kenaf plant can be sized to produce a variety of products including animal bedding and industrial sorbents that are lightweight, ultra-absorbent, and 100% biodegradable. Corn stover, corncobs, peanut hulls, and other crop residues are used to absorb liquid spills.

Sorbent Systems

Sorbents can be placed in containers, packages, gauzes, or other carriers to create a sorbent system. This aids in handling of the sorbent and better application of the sorbent at a location to achieve greatest benefit. The sorbent carrier may be of a material other than a biobased product – although use of biobased products as carriers is encouraged. For the purposes of this category, the biobased material is the 'active' part of the sorbent system.

Plant starch contained within a cotton bag is an illustration of a sorbent system. While the plant starch is not the end product, it is the "active" ingredient in these sorbent systems. USDA's Agricultural Research Service developed a patented sorbent gel that would be a sorbent system. The gel is capable of absorbing hundreds of times its own weight in water and has been applied as seed coatings, wound dressings, automobile fuel filters, plastic barriers used at construction sites, and most notably disposable diapers.

ATTACHMENT B:

Invited Document Reviewers

THE FOLLOWING ORGANIZATIONS PROVIDED INPUT TO THE USDA BIOBASED PRODUCT CONTENT GUIDELINE SUMMARY REVIEWED IN ATTACHMENT A:

1.0 Adhesives	Office, Federal Environmental Executive USDA, CSREES USDA, REE USDA, OCE&NU NW P2 Resource Center HQ DLA *CTC* OmniTech American Forest and Paper Association Kansas State University USDA, Agricultural Research Service
2.0 Construction Materials and Composites	Office, Federal Environmental Executive USDA, CSREES USDA, REE USDA, OCE&NU NW P2 Resource Center DLA *CTC* US Forest Service American Forest and Paper Association University of Delaware – Newark
3.0 Fibers, Paper & Packaging	Office, Federal Environmental Executive USDA, CSREES USDA, REE USDA, OCE&NU NW P2 Resource Center DLA *CTC* Kansas State University Vision Paper Kafus Industries American Forest and Paper Association

4.0 Fuels and Fuel Additives	Office, Federal Environmental Executive USDA, CSREES USDA, REE USDA, OCE&NU Renewable Fuels Association NW P2 Resource Center DLA National Biodiesel Board *CTC* OmniTech Marc IV
5.0 Inks	Office, Federal Environmental Executive USDA, CSREES USDA, REE Nat'l. Assoc. of Printing Ink Manufacturers Clemson University (former) USDA, OCE&NU ARS-USDA NW P2 Resource Center DLA Eastman Chemical (former) *CTC* OmniTech Int'l. Paint/Printing Ink Council Nat'l. Assoc. of Printing Leadership
6.0 Landscaping Materials	Office, Federal Environmental Executive USDA, CSREES University of Hawaii USDA, REE Cannon Consultants USDA, OCE&NU NW P2 Resource Center DLA US Forest Service *CTC* USDA, ARS USDA, ARS

7.0 Lubricants and Functional Fluids	Office, Federal Environmental Executive USDA, CSREES USDA, REE Cargill USDA, OCE&NU NW P2 Resource Center DLA University of Northern Iowa *CTC* OmniTech US Army, TARDEC Marc IV
8.0 Paints and Coatings	Office, Federal Environmental Executive USDA, CSREES USDA, REE USDA, OCE&NU Cargill NW P2 Resource Center DLA *CTC* OmniTech American Forest and Paper Association National Paint and Coating Association University of Southern Mississippi

9.0 Plastics – Monomers & Polymers	Office, Federal Environmental Executive Midwest Grain Products USDA, CSREES ASTM USDA, REE USDA, OCE&NU NW P2 Resource Center Dow Cargill DLA *CTC* Omni Tech USDA, ARS Michigan State University Kansas State University University of Southern Mississippi USDA, ARS DLA, Philadelphia University of Delaware – Newark
10.0 Solvents and Cleaners	Office, Federal Environmental Executive USDA, CSREES USDA, REE USDA, OCE&NU NW P2 Resource Center DLA *CTC* OmniTech TARDEC, Warren Michigan
11.0 Sorbents	Office, Federal Environmental Executive USDA, CSREES USDA, REE Ken-Gro Corporation Oil Gator Product Services Company USDA, OCE&NU NW P2 Resource Center DLA *CTC* Mt. Pulaski Products, Inc USA Absorbents, Inc.